

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 4

**Remarks: General**

A petition under 37 CFR §1.136 for a three-month extension of time to respond to the Examiner's action is enclosed, the fee for which should be charged to Deposit Account No. 04-1928 (E.I. du Pont de Nemours and Company).

By Applicant's calculation, no fee is due by reason of this amendment to the claims. If any fee other than or in addition to the extension fee mentioned specifically above is required to authorize or obtain consideration of this response, please charge such fee to Deposit Account No. 04-1928.

Claims 4~8 and 13~15 are now active in the application. Applicant hereby requests reconsideration and further examination of the application in view of the reasons it has set forth below for allowance of the claims.

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 5

**Remarks: Detailed Action****I.**

In Section 2, the Examiner has objected to the disclosure because of informality in respect of four specified items. The written description has been amended as suggested by the Examiner in respect of those items, and Applicant therefore respectfully requests that the Examiner withdraw this objection.

**II.**

In Section 3, the Examiner has objected to Claims 4, 13 and 16 because of informality in respect of the manner in which "n >= 1" is presented in the text. Claim 16 has been canceled. As Claims 4 and 13 have been amended in the manner as suggested by the Examiner, Applicant respectfully requests that the Examiner withdraw this objection.

**III.**

In Section 4, the Examiner has rejected Claim 13 under 35 U.S.C. §112, second paragraph, with respect to the use of the expression "ca.". As shown in *Webster's New Collegiate Dictionary* (G.&C. Merriam Co., Springfield MA, 1981) on pages 151 and 200 (copy attached), the expression "ca." is defined as an abbreviation for the word "circa", which in turn may be defined as "approximately". Claim 13 has therefore been amended to replace the expression "ca." with a suitable word having the same meaning, and, instead of "approximately", the word "about" has been chosen as being a word frequently used in claim drafting. Applicant therefore respectfully requests that the Examiner withdraw the rejection of Claim 13 under 35 U.S.C. §112.

**IV.**

In Section 7, the Examiner has rejected Claims 4-8 and 13-17 under 35 U.S.C. §103(a) as being unpatentable over WO 98/31716 ("Drysdale") in view of WO 97/23448 ("Howells") and US 4,349,650 ("Krespan"). Claims 16 and 17 have been canceled.

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 6

## A.

With respect to Claims 4~8, Drysdale discloses grafting the specified monomer,  $\text{CH}_2=\text{CHR}^1\text{R}^2\text{R}^6\text{Y}$ , to a polymer such as polyethylene, a polyether or an ethylene copolymer. Drysdale does not teach or suggest grafting the monomer to a polymer prepared from  $\text{VF}_2$  (vinylidene fluoride).

Krespan discloses a variety of monomers, all of which are fluorinated on the alpha carbon, and none of which contain an acid or ionized end group. These monomers may, however, be copolymerized with  $\text{VF}_2$ .

There would be no motivation for the artisan to replace the monomer utilized in the copolymers of Krespan with the monomer used for grafting in Drysdale because (1) the alpha carbon of the Krespan monomer is fluorinated whereas the alpha carbon of the Drysdale monomer is not; (2) the Drysdale monomers that would, in the Krespan copolymer, give Applicant's claimed polymers have an acid or ionized end group, and Krespan does not incorporate any such monomers in its system; and (3) Drysdale discloses the use of its specified monomer for the purpose of grafting it to a previously-prepared polymer rather than copolymerizing it with another monomer.

Howells does not add anything to overcome the deficiencies of the other two references in this regard because, while it does disclose a method of preparing (fluoroalkylsulfonyl) (fluorosulfonyl) imides and discloses that they may be polymerized, it does not teach or suggest  $\text{VF}_2$  as a comonomer.

With respect to comment (1) above concerning the alpha carbon, the Examiner has alleged that  $\text{CH}_2=\text{CH-}$  systems are equivalent to  $\text{CF}_2=\text{CF-}$  systems, but Applicant respectfully submits that such equivalence is not recognized by the references discussed above.

## B.

With respect to Claims 13~15, Drysdale does not teach or suggest a process such as claimed because all manipulations performed in Drysdale are performed on the sulfonyl fluoride end group after the monomer has been grafted to the base polymer (see, e.g., Examples 3, 4, 6, 7, 9 and 10). In Krespan, similarly, such

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 7

manipulations are performed after a copolymer has been prepared (see, e.g., 11/64 to 12/11).

Moreover, there is no disclosure in either of those references of performing the step at a pH of less than about 12.

Howells does not add anything to overcome the deficiencies of the other two references in this regard because it is directed to the preparation of an imide from a sulfonyl fluoride rather than the acid or salt form thereof.

In view of these distinctions between the subject matter of Claims 4~8 and 13~15 and the references discussed above, Applicant respectfully requests that the Examiner withdraw the rejection of those claims under 35 U.S.C. §103(a).

V.

Applicant has reviewed the reference that has been made of record but is not relied on, and submits that it is of no greater pertinence to the claims than the references discussed in detail above.

In view of the foregoing, Applicant submits that all of the Examiner's objections and rejections have been properly traversed, and that the pending claims are in condition for allowance, request for which is hereby respectfully made.

Respectfully submitted,



John A. Langworthy  
Attorney for Applicant  
Registration No. 32,255  
Telephone: (302) 992-4362  
Facsimile: (302) 992-5374

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 8

**Appendix A**  
Marked-Up Version of  
Original Form of Deleted Paragraphs,  
Showing Changes Thereto from Which  
Replacement Paragraphs Are Derived

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**Paragraph 001**

Monomers of the formula



where  $n > 1$  are disclosed in WO 9831716.  $n=1-4$  compositions are explicitly disclosed in Chen et al, "Perfluoro and polyfluorosulfonic acids", Huaxue Xuebao (1982), 40(10), 904-12.

**Paragraph 002**

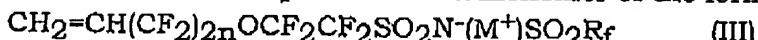
See for example, Ezzell et al. U.S. 4,940,525, wherein is used 25 wt % NaOH(aq) for 16 hours at 80-90°C; Banerjee et al. U.S. 5,672,438, wherein is used 25 wt % NaOH for 16 hours at 90°C, or, in the alternative, an aqueous solution of 6-20% alkali metal hydroxide and 5-40% polar organic liquid (e.g., DMSO) for 5 minutes at 50-100°C; Ezzell et al.

U.S. 4,358,545 wherein is used 0.05N NaOH for 30 minutes for 50°C; Ezzell et al. U.S. 4,330,654, wherein is used 95% boiling ethanol for 30 minutes followed by addition of equal volume of 30% NaOH (aq) with heating continued for 1 hour; Marshall et al. EP 0345964 A1, wherein is used 32 wt % NaOH (aq) and methanol for 16 hours at 70°C, or, in the alternative, an aqueous solution of 11 wt % KOH and 30 wt % DMSO for 1 hour at 90°C; and, Barnes et al. U.S. 5,595,676, wherein is used 20 wt % NaOH (aq) for 17 hours at 90°C.

Application No. 10/602,755  
 Art Unit 1713, Examiner Hu  
 Docket No. CL-1459 US DIV  
 October 20, 2005  
 Page No. 9

### Paragraph 003

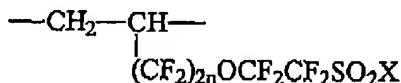
The present invention provides for a monomer of the formula



where  $n \geq 1$ ,  $n \geq 1$  and  $\text{M}^+ = \text{H}^+$  or an alkali metal cation, and  $\text{R}_f$  is C1-4 perfluoroalkyl optionally substituted by one or more ether oxygens.

### Paragraph 004

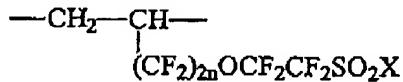
The present invention further provides for a polymer comprising monomer units of  $\text{VF}_2$  and 1 to 40 mol % of ionic monomer units of the formula



where  $n \geq 1$ ,  $n \geq 1$ ,  $\text{X}$  is  $\text{O}^-\text{M}^+$ , or  $\text{N}^-(\text{M}^+)\text{SO}_2\text{R}_f$  where  $\text{M}^+$  is  $\text{H}^+$  or an alkali metal cation and  $\text{R}_f$  is C1-4 perfluoroalkyl optionally substituted by one or more ether oxygens.

### Paragraph 005

Further provided is a polymer comprising monomer units of ethylene, tetrafluoroethylene, and 4 to 20 mol % of functionalized monomer units of the formula



where  $n \geq 1$ ,  $\text{X}$  is  $\text{F}$ ,  $\text{O}^-\text{M}^+$ , or  $\text{N}^-(\text{M}^+)\text{SO}_2\text{R}_f$  where  $\text{M}^+$  is  $\text{H}^+$  or an alkali metal cation and  $\text{R}_f$  is C1-4 perfluoroalkyl optionally substituted by one or more ether oxygens.

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 10

### Paragraph 006

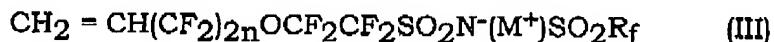
Further provided is a process for forming a composition of the formula  $\text{CH}_2=\text{CH}(\text{CF}_2)_{2n}\text{OCF}_2\text{CF}_2\text{SO}_3^-\text{M}^+$  where  $n \geq 1$ ,  $\text{M}^+$  is  $\text{H}^+$  or an alkali metal cation, the process consisting essentially of contacting a composition represented by the formula  $\text{CH}_2=\text{CH}(\text{CF}_2)_{2n}\text{OCF}_2\text{CF}_2\text{SO}_2\text{F}$  with weakly basic solution of an alkali metal salt or hydroxide in a polar solvent, the solution having a pH of less than ca. 12, at a temperature in the range of 0-50°C.

### Paragraph 007

Further provided is a process for forming a composition of the formula  $\text{CH}_2=\text{CH}(\text{CF}_2)_{2n}\text{OCF}_2\text{CF}_2\text{SO}_2\text{N}^-(\text{K}^+)\text{SO}_2\text{R}_f$  where  $n \geq 1$ ,  $\text{R}_f$  is C1-4 perfluoroalkyl optionally substituted by one or more ether oxygens, the process consisting essentially of forming a 0.001-5 molar solution of  $\text{R}_f\text{SO}_2\text{NH}_2$  in an organic solvent; combining said solution with  $\text{CH}(\text{CF}_2)_{2n}\text{OCF}_2\text{CF}_2\text{SO}_2\text{F}$  and KF to form a mixture; heating said mixture to 50-180°C; and separating the product.

### Paragraph 008

The present invention provides for a monomer represented by the formula

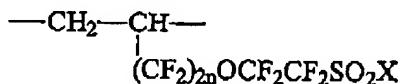


where  $n \geq 1$ ,  $n \geq 1$  and  $\text{M}^+$  =  $\text{H}^+$  or an alkali metal cation, and  $\text{R}_f$  is C1-4 perfluoroalkyl optionally substituted by one or more ether oxygens. Preferably  $\text{R}_f$  is  $\text{CF}_3$ , and  $\text{M}^+$  is  $\text{H}^+$  or  $\text{Li}^+$ .

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 11

### Paragrpah 009

The composition of the polymer depends on the ratio of monomers. This was true for all three monomers. One of skill in the art will appreciate that specific reactivity ratios of monomers is determined by the particulars of monomer structure. Accordingly, the present invention provides for an ionomer comprising monomer units of  $VF_2$  and 1 to 40 mol % of monomer units described by the formula



where  $n \geq 1$ ,  $n \geq 1$ , X is  $\text{O}^- \text{M}^+$ , or  $\text{N}^-(\text{M}^+)\text{SO}_2\text{R}_f^-$  where  $\text{M}^+$  is  $\text{H}^+$  or an alkali metal cation and  $\text{R}_f$  is C1-4 perfluoroalkyl optionally substituted by one or more ether oxygens. Preferably the concentration of ionic monomer units is 4-20 mol %, most preferably 6-16 mol %. Preferably X is  $\text{N}^-(\text{M}^+)\text{SO}_2\text{R}_f^-$  where M is lithium and  $\text{R}_f$  is  $\text{CF}_3$ .

### Paragraph 010

In a preferred embodiment of the process of the invention, monomer (I) and the polymers of the invention formed from (I) are contacted at a temperature in the range of 50-180°C, preferably 70-120°C, with a 0.001-5.0 molar solution of  $\text{CF}_3\text{SO}_2\text{NH}_2$  in an organic solvent in the presence of KF precharged to the reaction vessel to form the potassium imide form of (III) or the polymer formed therefrom. Suitable organic solvents include toluene, chlorobenzene, THF, and oligo ethers. Preferred is acetonitrile. Other ionic forms can be formed by contacting the potassium imide form with an alkali metal salt solution, such as LiCl in methanol, or an acid such as aqueous HCl.

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 12

**Paragraph 011****EXAMPLE 8**

Copolymerization of  $\text{CH}_2=\text{CHCF}_2\text{CF}_2\text{OCF}_2\text{CF}_2\text{SO}_2\text{F}$  with  
TFE

**and ethylene in F113**

A 240-mL stainless steel tube was charged with 100 mL of 1,1,2-trichlorotrifluoroethane (F113), 10 g of  $\text{CH}_2=\text{CHCF}_2\text{CF}_2\text{OCF}_2\text{CF}_2\text{SO}_2\text{F}$  and 0.8 g of Lupersol 11 and attached to a gas manifold. The tube was cooled in dry ice and the contents degassed by several cycles of evacuation and repressurization with nitrogen gas. After the final evacuation step, the tube was pressurized with 10 g of ethylene and 30 g of TFE. The tube was then sealed and heated to 60°C and held for 8 hours to effect polymerization. After completion of the polymerization, the unreacted ethylene and TFE were removed by venting and the white solid was washed with MeOH and dried in a partial vacuum oven at 80°C to give 47.0 g of polymer. IR(KBr): 1464  $\text{cm}^{-1}$  ( $\text{SO}_2\text{F}$ ). Elementary analysis of polymer indicated that polymer composition was 8.67 parts ( $\text{CF}_2\text{CF}_2$ ) and 5.36 parts ( $\text{CH}_2\text{CH}_2$ ) to 1 part ( $\text{CH}_2=\text{CHCF}_2\text{CF}_2\text{OCF}_2\text{CF}_2\text{SO}_2\text{F}$ ) on a molar basis, based on 37.0% of C, 3.12% of H, 52.3% of F and 2.73% of S. DSC showed that the polymer had  $T_m$  of 214°C. By TGA, 10% weight loss was 430°C by TGA in  $\text{N}_2$ . A clear transparent and tough film was pressed by placing a sample of the polymer so formed between the platens of a hydraulic press and heated to 250°C with a ram force 20,000 lbs.

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 13

## Appendix B

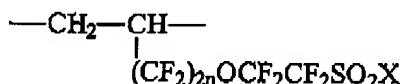
**(i) Amendments**  
in marked-up form to  
Claims 4 and 13, and

**(ii) Status of all other claims**

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1 ~ 3. (canceled).

4. (currently amended) A polymer comprising monomer units of VF<sub>2</sub> and 1 to 40 mol % of ionic monomer units described by the formula



where  $n \geq 1$ , X is O-M<sup>+</sup>, or N-(M<sup>+</sup>)SO<sub>2</sub>R<sub>f</sub> where M<sup>+</sup> is H<sup>+</sup> or an alkali metal cation and R<sub>f</sub> is C1-4 perfluoroalkyl optionally substituted by one or more ether oxygens.

5. (original) The polymer of Claim 4 wherein the concentration of said ionic monomer units is 6 to 16 mol-%.

6. (original) The polymer of Claim 4 wherein X is N-(M<sup>+</sup>)SO<sub>2</sub>R<sub>f</sub> where M<sup>+</sup> is H<sup>+</sup> or an alkali metal cation and R<sub>f</sub> is C1-4 perfluoroalkyl optionally substituted by one or more ether oxygens.

7. (original) The polymer of Claim 4 or 6 wherein M<sup>+</sup> is H<sup>+</sup> or Li<sup>+</sup>.

8. (original) The polymer of Claim 6 wherein R<sub>f</sub> is CF<sub>3</sub>, and n=1.

9 ~ 12. (canceled).

Application No. 10/602,755  
Art Unit 1713, Examiner Hu  
Docket No. CL-1459 US DIV  
October 20, 2005  
Page No. 14

13. (currently amended) A process for forming a composition of the formula  $\text{CH}_2=\text{CH}(\text{CF}_2)_{2n}\text{OCF}_2\text{CF}_2\text{SO}_3^- \text{M}^+$  where  $n \geq 1$ ,  $\text{M}^+$  is  $\text{H}^+$  or an alkali metal cation, the process consisting essentially of contacting a composition represented by the formula  $\text{CH}_2=\text{CH}(\text{CF}_2)_{2n}\text{OCF}_2\text{CF}_2\text{SO}_2\text{F}$  with a weakly basic solution of an alkali metal salt or hydroxide in a polar solvent, the solution having a pH of less than ~~ea.~~about 12, at a temperature in the range of 0-50°C.

14. (original) The process of Claim 13 wherein the alkali metal salt or hydroxide is an alkali metal carbonate.

15. (original) The process of Claim 14 wherein the alkali metal carbonate is lithium carbonate.

16 ~ 17. (canceled).



WEBSTER'S  
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Collegiate  
Dictionary

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v having teeth on its periphery and ro.  
an important-sounding usu. technical  
term used chiefly to impress lay-

work — used for underwear

1 warfare; biological warfare 2 black  
list. *fr. Ar. abdām our father* chiefly Eng.  
in used as a noun of address

into bet prep [ME, prep. & adv., fr. OE  
þ, by, near, L. *ambī*, on both sides  
1 proximity to : NEAR (standing ~ the  
or through the medium of : via *inter*  
action of TOWARD (north ~ east)  
2 beyond : FART (went right ~ him) 3  
fixed ~ night) 4 : not later than (~  
agency or instrumentality of (~ force)  
witness or sanction of (swear ~ all that  
mity with (acted ~ the rules) 5 : in  
the amount or extent of (win ~ a nose)  
in with : sespns 6 : In successive trials  
tide ~ little) (walk two ~ two) 10  
multiplication, in division, and in mea-  
suring 10 ~ 4) (a room 15 feet ~ 20

word meaning element — used as a fun-  
damental word or phrase as an agent  
is followed commonly by the agent or  
by the Romans) (destroyed by fire)  
) THROUGH implies intermediary and is  
meant or something felt as the medium  
in gained or an effect produced  
Gathered his position through influ-  
enced by the name of the instrument  
agent or agency works (ate with a fork)  
or it may take for its object something  
a instrument though serving as the in-  
effect is produced. (Old speech in  
(face supported by singer)  
at hand : NEAR 1 : at or to another,  
2 : FART (gave him go ~) 3 : ASIDE

the main route : side 2 : INCIDENTAL  
(bīz) : something of secondary impor-  
tance by the way : INCIDENTALLY  
1 : used to express fare-  
ing now

future time or occasion

before long : soon

dt : on the whole : in general

an indirect blow 2 : an illegitimate

part of a participant in a tourna-  
after pairs are drawn and advances to  
ing

bī, br. *Interf* [babby-talk] redupl. of good-  
will

adv : our esp. for a walk or ride —

wants to go ~ the baby may put his

for a hat — A.L. Gessel & Frances L.

a : BED, SLEEP (lie down ...) and go to  
adv : to bed or sleep — used with the  
for just a second ... and then perhaps

ion (bī-ə-lék-shən) n : a special circ-  
actions in order to fill a vacancy

adj : gone by : PAST: esp : OUTMODED

n [ME *bilaw*, prob. fr. (assumed) ON  
ig law] : a rule adopted by an organiza-  
tion of its members and the regulation

secondary line : STEDLINE 2 : a line of  
or magazine article giving the writer's

title) under a by-line — byline (bī-

secondary name 2 : NICKNAME

boozie : bring your own bottle

1 passage to one side; esp : a deflected  
2 a : a channel carrying a fluid  
to main stream b : SHUNT 1b

by means of a bypass b : to cause to  
neglect or ignore usu. intentionally b

ONE  
BYWAY

ngaged in on the side while the main

dramatic production)

1 : something arranged for in main-

byre (bīr) n [ME, fr. OE *bīr*: akin to OE *būr* dwelling — more  
at *bower*] chaffy *bīr* : a cow barn

Byronite (bīr'-nō-nīt) adj : of, relating to, or having the characteris-  
tics of the poet Byron or his writings — *Byron-ic* (bīr'-nīk) n

Byssus (bīs'-səs) n, pl. *byssuses* or *byssal* (bīs'-əl) 1, 2 [L, fr. Gr. *byssos* flax of Scop or *byssos* akin to Heb *būs* linen cloth] 1 : a fine  
prob. thin cloth of ancient times 2 [NL, fr. L.] : a tuft of long  
tough filaments by which some bivalve mollusks (as mussels) make  
themselves fast

Byzantander (bīz-ən-dər) n : one present but not taking part in a

situation or event : a chance spectator

Byzantine (bīz-ən-tīn') n : a street off a main thoroughfare : side street

Byzantine (bīz-ən-tīn') n [perh. pl. of *bīzis*] : a group of adjacent binary digits  
often shorter than a word that a computer processes as a unit (an

8-bit)

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situation or event : a chance spectator

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